REMARKS

Claims 1-8, 10-12 and 14-20 are pending in this application, of which Claims 1, 12 and 19 are in independent form. Claims 9 and 13 have been canceled, without prejudice or disclaimer of subject matter, and Claims 1, 2, 4, 10-12, 14, 16, 18 and 19 have been amended to define still more clearly what Applicant regards as his invention.

As required by the Examiner, a Substitute Specification (clean and marked versions), which does not add any new matter, and a Letter Submitting Corrected Drawing are submitted herewith.

Applicant notes with appreciation the Examiner's indication that Claims 19 and 20 would be allowable if rewritten in independent form, with no change in scope. Claim 19 has been so rewritten, with only minor formal changes not affecting scope, and both these claims are therefore believed to be in condition for allowance.

Claims 1, 2, 4, 5, 11, 12, 14, 16 and 17 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,804,832 (Crowell). Claims 3 and 15 were rejected under 35 U.S.C. § 103(a) as being obvious from *Crowell* in view of U.S. Patent 6,211,626 (Lys et al.), Claims 6-10 and 13, as being obvious from *Crowell* in view of U.S. Patent 5,796,109 (Frederick), and Claim 18, as being obvious from *Crowell* (Claim 18 also was objected to due to a minor informality).[1]

1/ It is noted that U.S. Patent 5,796,109 (Frederick et al.), relied upon at pages 5 and 6 of the Office Action, has not been formally made of record, nor was a copy provided with the Office Action. Applicant respectfully requests that the Examiner make *Frederick* properly of record by listing that patent on a form PTO-892 and supplying a copy of that form to Applicant with her next Action.

As is described in more detail in the present application, portable X-ray machines have become increasingly important in recent years, and it is necessary in the construction of such machines to take into account the increased opportunities for damage to such a machine due to its being moved from one place to another. Another consideration is to make the machine highly adaptable, so that it can be used easily to make radiographs of various portions of a patient's body. The present invention is intended to provide a structure suitable for use in such a machine (although the scope of the invention is not limited to machines that are designed for or actually used as mobile or portable machines), which will permit the resulting structure to be compact and light-weight, but also sturdy.

Independent Claim 1 is directed to a radiation imaging system comprising a radiation image detection panel having means for converting radiations into electric signals, an outer enclosure which holds therein the radiation image detection panel, an elastic support means, and a cushioning material provided between the radiation image detection panel on a radiation incident side and the outer enclosure. According to Claim 1, the radiation image detection panel is elastically supported by the elastic support means toward the outer enclosure, from the side opposite to the radiation incident side of the radiation image detection panel.

Crowell relates to a digital array for radiographic imaging, which uses shock absorbing mounts 40 (see Figs. 5 and 6). Even if the absorbing mounts 40 are assumed to support a radiation image detection panel 22 toward an outer enclosure, nothing has been found, or pointed out, in *Crowell* that would teach or suggest the arrangement recited in Claim 1, according to which a cushioning material is provided between the radiation image detection panel on a radiation incident side and the outer enclosure.

Since an object to be radiographed, such as a patient's body, is positioned at the radiation incident side of the apparatus, it often happens that the body receives impact from the radiation incident side. With the *Crowell* construction, there is a possibility that the radiation image detection panel could be damaged by such an impact, if the impact were to deform the panel. In contrast, according to the construction recited in Claim 1, such damage to the panel caused by an impact from the radiation incident side can effectively be prevented. Since no suggestion of this arrangement is to be found in *Crowell*, Applicant submits that Claim 1 is clearly allowable over that patent, taken alone.

Moreover, even if *Frederick* is taken as disclosing all that it is cited for, such would not provide any teaching or suggestion that a cushioning material provided between the radiation image detection panel on a radiation incident side and the outer enclosure, as recited in Claim 1, and even if these two patents are combined as proposed in the Office Action (and assuming that such combination would be a permissible one), the result would provide no guidance to one of merely ordinary skill to place a cushioning material in the location recited in Claim 1. Accordingly, that claim is believed clearly to be allowable over both *Frederick* and *Crowell*, taken separately or in any proper combination.

A review of the other art of record has failed to reveal anything which, in Applicant's opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other rejected claims in this application are each dependent from one or the other of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional

aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

In view of the foregoing remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicant's undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

Attorney for Applicant

Registration No. 28,28

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3801
Facsimile: (212) 218-2200

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TITLE

RADIATION IMAGING SYSTEM

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention relates to a radiation imaging system for obtaining images two-dimensionally.

Related Background Art

[0002] In conventional radiation ~~photographing~~ photography, a film screen system made up of sensitized paper and radiation-photographic film in combination is in wide use. According to this method, radiation~~s having~~ that has passed through a subject such as a patient ~~hold the interior~~ contain information about the interior of the subject ("interior information"), the information is converted into visible light proportional to the intensity of the radiation~~s~~ by means of the sensitized paper, and the radiation-photographic film is exposed to the light to form a radiation image on the film.

[0003] Such a film exposure method, however, requires the step of developing the film before a doctor obtains the radiation image of the patient, and has ~~had a~~ suffered from the problem that the developing step takes much labor and time. In addition,

radiation-photographic films obtained by photography must be stored for a certain period in hospitals or ~~usual~~ doctor's offices, and the films stored may ~~make an~~ be enormous in number, causing ~~to cause~~ a great problem ~~on~~ for management.

[0004] To cope with such problems, recent progress in technology has brought about an increasing demand for the materialization of recording-and-reproduction of radiation image information by means of electric signals, and has already brought forward a proposal ~~on~~ for a radiation imaging system in which radiatio~~ns are~~ is converted into visible light proportional to the intensity of the radiatio~~ns~~ by means of a phosphor, and the light is converted into electric signals by the use of a photoelectric conversion element. This system has begun to be put into practical use.

[0005] Such an imaging system used in radiation ~~photographing~~ photography or the like is constituted basically of a fluorescent plate which converts radiatio~~ns~~ into visible light, a photoelectric conversion element which converts the visible light into electric signals, a substrate on which the photoelectric conversion element is mounted, a base rest which supports the substrate, a circuit board with wiring on which electronic parts for processing the photoelectrically converted electric signals are mounted, and an outer enclosure which holds these constituents~~ internally~~.

[0006] This is described below with reference to Fig. 15. In Fig. 15, reference numeral 1 denotes a radiation image detection panel which detects radiatio~~ns~~ and convert ~~them~~ it into electric signals. It is constituted basically of a fluorescent plate 1a, a photoelectric conversion element 1b and a substrate 1c. For the substrate 1c of the photoelectric conversion element 1b, glass sheets are widely used because it is required to ~~cause~~ undergo no chemical action with semiconductor devices, to be durable ~~to~~ at the temperatures used in ~~of~~ semiconductor processing, and to have ~~a~~ dimensional stability.

[0007] For the fluorescent plate 1a, a resin sheet coated with a phosphor comprised of a metal compound is used, and the fluorescent plate is unified with the substrate 1c through an adhesive. Where the photoelectric conversion element 1b is required to have moisture resistance, the fluorescent plate 1a and the photoelectric conversion element 1b are sealed with a moisture-impermeable and radiation-transmissive film (not shown) in some cases.

[0008] These are fastened to the base rest 4 via a spacer 4a by bonding, ~~as~~ thus forming the radiation image detection panel 1. Reference numeral 5 denotes a circuit board on which electronic parts 5a for processing the photoelectrically converted electric signals are mounted, and which is connected with the photoelectric conversion element 1b through a flexible circuit board 6. These are fastened inside a casing 2 and are further closed with a radiation-transmissive casing cover 3. In this way, ~~, thus~~ the radiation imaging system is set up ~~in the state it is~~ hermetically sealed in an outer enclosure consisting of the casing 2 and the casing cover 3.

[0009] Imaging systems of this kind have hitherto been used in radiation imaging systems of a stationary type. In recent years, however, there has also come to be a demand for imaging systems of a portable type which are light-weight and compact so that the ~~photographing~~ photography can be ~~made~~ performed rapidly, ~~in a~~ with high precision and also on various portions of the human body.

[0010] Accordingly, in the designing of systems it has come to be taken into consideration that a load is partly applied by a subject (patient) to the casing cover 3, causing ~~to cause~~ the outer enclosure to deform and so to come into contact with the radiation image detection panel 1, breaking the latter ~~to break it~~, and thus it has come to be required to pay attention ~~sufficiently~~ also to resistance to deformation under load. Especially for the purposes of protecting the substrate 1c from any impact and vibration

applied when thee apparatus is carried and from any possible breakage when dropped, and of preventing the outer enclosure from undergoing deformation due to any load applied at the time of radiation ~~photographing~~ photography, it has been necessary for the base rest 4, the outer enclosure (casing 2 and casing cover 3) and so forth to have a strong structure. In order to protect the inside radiation image detection panel 1 from any breakage caused ~~when~~ by the casing cover 3 ~~deforms to come~~ deforming and coming into contact with it, it is necessary to keep a large space between the casing cover 3 and the radiation image detection panel 1 (fluorescent plate). This hinders the imaging system from being made compact and light-weight. If, however, the casing cover 3 is made ~~to have~~ with an excessively large thickness to make it strong, the casing cover 3 may absorb significant radiation~~s~~ when the radiation~~s~~ pass through it, ~~so that any~~ making the production of good images problematic~~may be hindered from being produced. There have been such problems~~.

SUMMARY OF THE INVENTION

[0011] The present invention was made in order to solve the above problems. Accordingly, an object of the present invention is to provide a radiation imaging system which ~~has achieved an improvement in~~ enjoys properties ~~such as~~ of resistance to deformation under load, resistance to impact and resistance to vibration~~,~~ and is compact and light-weight.

[0012] To achieve this object, the radiation imaging system of the present invention comprises a radiation image detection panel having means for converting radiation~~s~~ into electric signals, and an outer enclosure which holds therein the radiation image detection panel. An ~~, wherein, the radiation imaging system further comprises an~~ elastic

support means~~, and~~ elastically supports the radiation image detection panel ~~is elastically supported by the elastic support means toward~~ relative to the outer enclosure.

[0013] With such a construction, even when ~~any~~ load is applied by the subject (patient) to the casing cover of the outer enclosure, deforming ~~to cause~~ the casing cover ~~to deform~~, the radiation image detection panel can move toward the inside, acting against the elasticity of the elastic support means. Also, even ~~against any~~ impacts and vibrations occurring ~~applied~~ when the apparatus is carried~~, the load applied to the radiation image detection panel~~ can be absorbed by the elastic support means~~, and~~ sufficiently that the panel can be prevented from breaking.

[0014] Details will become apparent from the description of the preferred embodiments below~~Embodiments described later~~.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Fig. 1 is a cross-sectional view of a radiation imaging system according to ~~First Embodiment~~ a first embodiment of the present invention.

[0016] Fig. 2 is a cross-sectional view of a modification of the radiation imaging system according to ~~First Embodiment~~ the first embodiment.

[0017] Fig. 3 is a cross-sectional view of a radiation imaging system according to ~~Second Embodiment~~ a second embodiment of the present invention.

[0018] Fig. 4 is a cross-sectional view of a modification of the radiation imaging system according to ~~Second Embodiment~~ the second embodiment .

[0019] Fig. 5 is a cross-sectional view of a radiation imaging system according to ~~Third Embodiment~~ a third embodiment of the present invention.

[0020] Fig. 6 shows a condition ~~where~~ in which a load is applied to the device shown in Fig. 5.

[0021] Figs. 7A, 7B, 7C, 7D and 7E show examples for constructing the elastic support means used in the present invention.

[0022] Fig. 8 is a cross-sectional view of a modification of the radiation imaging system according to ~~Third Embodiment~~ the third embodiment .

[0023] Fig. 9 shows a condition ~~where~~ in which a load is applied to the device shown in Fig. 8.

[0024] Fig. 10 is a cross-sectional view of a radiation imaging system according to ~~Fourth Embodiment~~ a fourth embodiment of the present invention.

[0025] Fig. 11 is a cross-sectional view of a modification of the radiation imaging system according to ~~Fourth Embodiment~~ the fourth embodiment.

[0026] Fig. 12 is a cross-sectional view of another modification of the radiation imaging system according to ~~Fourth Embodiment~~ the fourth embodiment.

[0027] Fig. 13 is a cross-sectional view of a radiation imaging system according to ~~Fifth Embodiment~~ a fifth embodiment of the present invention.

[0028] Fig. 14 is a cross-sectional view of a modification of the radiation imaging system according to ~~Fifth Embodiment~~ the fifth embodiment.

[0029] Fig. 15 is a cross-sectional view of a conventional radiation imaging system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] Embodiments of the present invention are described below with reference to the accompanying drawings.

(First Embodiment)

[0031] Fig. 1 cross-sectionally illustrates a radiation imaging system according to ~~First Embodiment~~ a first embodiment of the present invention. In Fig. 1, reference numeral

1a denotes a fluorescent plate; 1b, a semiconductor device such as a photoelectric conversion element or a radiation detector, disposed two-dimensionally; and 1c, a substrate such as a glass sheet. These are integrally formed to make up a radiation image detection panel 1 as a whole. Reference numeral 4 denotes a support plate ~~for~~ supporting the radiation image detection panel 1, which is fastened to the latter by both being bonded to ~~bonding via~~ a spacer 4a which is between them. This support plate, however, need not be provided, and ~~so that~~ the substrate 1c may be directly ~~be~~ supported by an elastic support means as described below. An outer enclosure is constituted of a casing 2 and a casing cover 3 sealed to the former's open-top edge.

[0032] Reference numeral 6 denotes a flexible circuit board through which signals of the photoelectric conversion element are taken out; and 5, a circuit board on which electronic parts 5a for processing the signals are mounted. The circuit board 5 is, for the purpose of making the device compact, disposed between the back of the support plate 4 and the bottom of the casing 2 and is attached to the inside of the casing 2 with a means such as screws.

[0033] A glass sheet or the like is used as the substrate 1c. On the inside of the casing cover 3, a sheetlike cushioning material 7 formed of a radiation-transmissive elastic material is provided between the casing cover 3 and the radiation image detection panel 1. Since the cushioning material 7 is provided, the radiation image detection panel 1 can uniformly receive pressure when it is pressed, and hence the radiation image detection panel 1 can more preferably be prevented from, e.g., being scratched. The cushioning material 7 need not particularly be provided, depending on the material of the outer enclosure or the purpose of radiation detection. The radiation image detection panel 1 is pressed toward the casing cover 3 of the outer enclosure optionally via the cushioning material 7 (i.e., the latter material 7 is between the panel 1 and the cover 3),

by means of at least one compression coiled spring 8a which is the elastic support means according to the present embodiment of the invention. As the cushioning material 7, a flexible formed resin or a rubber member may be used. A sheet-like member of about 3 mm thickness made by expanding a silicone resin may preferably be used, since decrease in radiation transmittance ca be prevented.

[0034] At the time of radiation photographing, the load may be applied by a subject (patient) to the casing cover 3 as stated previously, but the radiation image detection panel 1 can escape therefrom acting against the compression coiled springs 8a. Hence, this can serve to prevent any break of the panel.

[0035] Incidentally, the casing 2 and the casing cover 3 are required to have the performance of resisting the deformation under load and the performance of transmitting the radiations and to be light-weight, and hence may preferably be made up using a metallic material and a material such as CFRP (carbon fiber reinforced plastic) in combination.

[0036] In the present embodiment, the circuit board 5 is fastened to the casing 2 through protrusions 2a provided partly thereon, with a means such as screws, and only the radiation image detection panel 1 is elastically supported with the compression coiled springs 8a in the direction of irradiation. Accordingly, ~~not so~~ only a moderately strong elastic force is required.

[0037] The compression coiled springs 8a also force the support plate 4 up, extending through the circuit board 5~~, and~~ (the circuit board 5 has holes at the part where the compression coiled springs 8a are provided, and is made up as a perforated board). Also, in place of the compression coiled spring 8a, leaf springs 8b may be used, as shown in Fig. 2. Still also, the fluorescent plate 1a, which is a wavelength conversion

member, is provided for detecting radiation~~s~~, but need not particularly be provided where a device directly sensitive to radiation~~s~~ is used in the radiation detector.

[0038] The present embodiment may particularly preferably be used when a material which is very fragile and is weak ~~to~~ under loads and impacts, such as a glass sheet, is used as the substrate 1c.

[0039] In the following ~~Embodiments~~ embodiments, component parts which function like those shown in the previous drawings are denoted by like reference numerals to avoid repeating their description.

(Second Embodiment)

[0040] Fig. 3 is a cross-sectional view of a radiation imaging system according to ~~Second Embodiment~~ the second embodiment of the present invention, which is so constructed that the circuit board 5 is not fastened to the ~~the~~ casing 2 but fastened to the support plate 4 through protrusions 4a provided partly thereon, with a means such as screws. Thus, the compression coiled springs 8a force the radiation image detection panel 1 and circuit board 5 up via the support plate 4 in the direction of the casing cover 3. Also, in place of the compression coiled spring 8a, leaf springs 8b may be used, as shown in Fig. 4.

[0041] Since in the present embodiment the circuit board 5 is not fastened to the casing 2, ~~such~~ this construction can be more effective against any impacts and vibrations ~~at the time of~~ during transportation, compared with ~~the~~ constructions in which ~~where~~ it is fastened thereto.

(Third Embodiment)

[0042] Fig. 5 is a cross-sectional view of a radiation imaging system according to ~~Third Embodiment~~ the third embodiment of the present invention. As shown in Fig. 5,

the radiation imaging system has a cylindrical stopper 2b which is provided on the casing 2 in such a way that it surrounds the lower half of each compression coiled spring 8a extending between the support plate 4 and the bottom of the casing 2, and restricts the range in which the support plate 4 is ~~downward~~ movable downward.

[0043] Fig. 6 shows a view where a load of the subject (patient) has been applied in the construction shown in Fig. 5. As shown in Fig. 6, each stopper 2b provided on the bottom of the casing 2 has the function ~~to~~ of restricting the movable range and at the same time the function ~~as~~ of a guide of the compression coiled spring 8a when the radiation image detection panel 1 moves downward with the deformation of the casing cover 3 upon application of a load 9 of the subject (patient) to the casing cover 3 at the time of radiation ~~photographing~~ photography. As is also apparent from the drawing, the use of the flexible circuit board 6 enables further absorption of ~~the~~ impacts. As can be seen from Fig. 6, it is preferable that since the electronic parts 5a are provided on the side opposite to the base rest side, the electronic parts 5a can be prevented from breaking ~~when a~~ under the load ~~of~~ applied by the subject ~~is applied~~ at the time of radiation ~~photographing~~ photography.

[0044] Here, the height of the stopper 2b is set a little larger than the height of the circuit board 5 so that the circuit board 5 and electronic parts 5a are not damaged when the support plate 4 (made integral with the radiation image detection panel 1 in this embodiment) moves downward and is restricted by the stopper. Also, the stopper 2b is so provided that it can pass through ~~each~~ holes formed in the circuit board 5.

[0045] The casing 2 and the casing cover 3 are required to have, as stated previously, adequate ability to ~~the performance of~~ resisting the deformation under loads, and ~~the performance of~~ to transmit~~ting the~~ incident radiations and ~~to~~ must be light-weight, and hence may preferably be made up using a metallic material and a material such as CFRP

(carbon fiber reinforced plastic) in combination. In the present embodiment, a magnesium alloy is used in the casing 2 as a material having a high modulus of elasticity and a small specific gravity, and CFPR having a high radiation transmittance is used in the casing cover 3.

[0046] With such construction of the present embodiment, even when a~~ny~~ load is applied by the subject (patient) to the casing cover 3, deforming ~~to cause~~ the outer enclosure~~ to deform~~, the radiation image detection panel 1 can escape ~~therefrom acting~~ damage by pressing against the compression coiled springs 8a, and hence the panel can be prevented from ~~damaging~~ being damaged or breaking.

[0047] In addition, in the present embodiment, only the casing cover 3 lies between the subject (patient) and the radiation image detection panel 1;~~, where~~ the distance between the subject (patient) and the radiation image detection panel 1 may be small, and also the outer enclosure, in particular, the casing cover 3, may deform. Even in such cases, the distance between them can always be kept constant by the action of the compression coiled springs 8a. Thus, any scattering, attenuation and so forth of radiation~~s~~ can be kept to a minimum, and good radiation images can be obtained.

[0048] With regard to ~~the~~ impacts and vibrations applied when the apparatus is carried and ~~the~~ possible breakage when dropped, the wavelength conversion member such as the fluorescent plate 1a can be made to function as a cushioning material 7 by ~~preparing it under~~ means of appropriate selection of layer thickness and choice of materials therefor, and can absorb the impact, and thus the radiation image detection panel 1 can be prevented from breaking.

[0049] The elastic support means used in the present embodiment may have the construction as shown in Figs. 7A, 7C and 7E. More specifically, the compression coiled spring 8a used here employs, as shown in Fig. 7A, a constant-pitch compression

coiled spring, the wire of which is wound into a series of spirals with constant pitches between them. In Fig. 7A, W represents the load; D, the average diameter of the coil; d, the diameter of the wire of the coil; H, the free height; and R, the distance from the center to the wire of the coil. In this case, the force acting on the spring, e.g., the relationship between a load W of a subject (patient) and a deflection δ of the casing cover 3, is ~~stands~~ linear, as shown in Fig. 7B. In other words, spring constant K = force W acting on spring/deflection δ is always invariable. Of course, such a compression coiled spring having an invariable spring constant K may be used. However, an elastic member that can sensibly respond first to the impact force or the load applied by the subject (patient) is preferred because the panel can then better be prevented from breaking.

[0050] More specifically, as shown in Fig. 7C, it is preferable to use a spring member whose spring constant K is small first and becomes larger gradually. As such a spring member, an inconstant-pitch compression coiled spring may preferably be used, whose spirals into which the wire is wound are not constant in distance (i.e., the spring constant K is not invariable) as shown in Fig. 7D. That is, this is because the turns of the coil come into close contact consecutively from the part having a smaller pitch and hence the number of windings that act effectively decreases with an increase in deflection.

[0051] The use of such an inconstant-pitch compression coiled spring can make small the amount of movement itself of the radiation image detection panel 1 and so forth, because the spring is made to sensibly respond first to the impact or load to absorb the impact force instantaneously and thereafter its displacement is made small with respect to the load. Thus, such a spring may preferably be used in order to make the device compact and light-weight.

[0052] As a further example, in relation to the space inside the radiation imaging system, a conical compression coiled spring as shown in Fig. 7E may be used in order to lessen the compression height of the spring as far as possible to make the device more compact. Such a conical compression coiled spring also has a spring constant K which is not invariable, and has the relationship between the load and the deflection just as shown in Fig. 7D. Hence, the compression height of the spring at its turn of the final stage can be made small, in fact close~~ly~~ to the coil wire diameter. Thus, such a spring may preferably be used in order to make the device compact and light-weight.

[0053] The use of ~~the~~ a spring whose spring constant K is invariable brings the natural frequency of the spring and the frequency of the device itself into agreement, and may thus ~~to~~ cause the phenomenon of resonance in some cases. On the other hand, the use of ~~the~~ a spring whose spring constant K is not invariable is more preferred, because then ~~it does not make~~ the natural frequency is not constant, and the phenomenon of resonance of the device itself can be avoided.

[0054] The system may also have the construction as shown in Fig. 8, in which the circuit board 5 is fastened to the support plate 4 through protrusions 4a provided partly thereon, with a means such as screws. A view where a load has been applied in such construction is shown in Fig. 9. As can be seen from Fig. 9, it is preferable that since the electronic parts 5a are provided on the side opposite to the base rest side, the electronic parts 5a can be prevented from breaking when ~~a~~ the load of the subject is applied at the time of radiation photographing.

(Fourth Embodiment)

[0055] Fig. 10 is a diagrammatic cross-sectional view of the present embodiment. The radiation image detection panel 1, the support plate 4 and the electric-circuit board

5 are held in an inner case 14 provided inside the outer enclosure, and the inner case 14 is elastically supported by means of an elastic support means, on the inner surface of the outer enclosure on the side of irradiation.

[0056] The inner case 14 is box-shaped, and is set open at least on the side where the radiation~~s are~~ is incident. On its open edges, it has a support flange 14a extending outward. The inner case 14 may be made from a metallic plate processed by press drawing, taking ~~account~~ advantage of the strength of such a material.

[0057] In the present embodiment, the elastic support means is constituted of an elastic member 10 provided on the inner surface of the casing cover 3 of the outer enclosure, and an elastic member 11a held between the support flange 14a and the inner bottom of the casing 2 along its inner sidewall. Alternatively, this elastic member 11a may be bonded to the inner surface of the casing 2. The elastic force of this elastic member 11a depends on its thickness, height, width and hardness.

[0058] In the present embodiment, the electric-circuit board 5 is supported by the support plate 4 and the radiation image detection panel 1, support plate 4 and electric-circuit board 5 are guarded by the inner case 14. Hence, the device can be protected not only from up-and-down vibrations but also from right-and-left swings. Also, on the sidewall, the elastic member 11a absorbs up-and-down impacts, and thus, this is preferable because the wall thickness of the casing 2 can be made small. Reference numeral 4c denotes a protrusion.

[0059] In place of the elastic member 11a, compression coiled springs 11b may also be used, as shown in Fig. 11, or leaf springs may be used. The use of the compression coiled springs 11a is preferable because the elastic support means can be assembled without use of any means such as ~~an~~ adhesives.

[0060] As also shown in Fig. 12, ~~as the elastic support means,~~ the elastic member or the like as the elastic support means may be divided so as to be provided partly on the side wall and partly on the bottom. Also, elastic members 11c which elastically supports the inner case 14 up and down and right and left may be provided on the side wall and the bottom inside the casing 2. In the case of such construction, the inner case 14 is not provided with any support flange 14a so that enough room for absorbing right-and-left vibrations can be ensured.

(Fifth Embodiment)

[0061] In the present embodiment, as shown in Fig. 13, the radiation image detection panel 1, the support plate 4 and the electric-circuit board 5 are supported by the inner case 14, and these are kept in a ~~hung-supported~~ suspension state by the elastic support means inside the casing 2. Hence, rubbery elastic members 11d are provided on the inner sidewall of the casing cover 3 at its upper part and bottom part, respectively, bordered at the support flange 14a.

[0062] As shown in Fig. 14, compression coiled springs 11e may also be used as the elastic support means.